

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPEAL BRIEF

PATENT

In re Application of : Betty Shu Mercer et al. Confirmation No.: 5550
Application Number : 10/828,592
Filed : April 21, 2004
Title : AN INTERCONNECT AND A METHOD OF MANUFACTURE
THEREFOR
TC/Art Unit : 2891
Examiner: : Steven J. FULK

Docket No. : TI-36275 (0025.0180)
Customer No. : **23494**

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Alexandria, VA 22313-1450

Sir:

APPEAL BRIEF UNDER 37 C.F.R. § 41.37(d)

Pursuant to the provisions of 37 C.F.R. § 41.37(d), this is a Brief on Appeal of the final rejection of claims 1-10 and 16-20 set forth in the Final Office Action dated April 16, 2007 and Advisory Action Mailed May 29, 2007. A Notice of Appeal was filed on July 13, 2007. The period for response has been extended one (1) month to October 13, 2007 by the petition and fee filed concurrently herewith.

Please find attached hereto a payment in the amount of \$630.00 which includes the Appeal Brief fee of \$510.00 set forth in 37 C.F.R. § 1.17(f) and extension fee of \$120.00 set forth in 37 C.F.R. § 1.17(a). If additional fees are required, please charge our Deposit Account No. 20-0668.

I. Real Party in Interest

The real party in interest is Texas Instruments Incorporated, a corporation of Texas, by virtue of an Assignment duly filed at Reel 015254, Frame 0319.

II. Related Appeals and Interferences

There are no related appeals or interferences known to the assignee which will directly affect or be directly affected by or have a bearing on the Board's decision on this Appeal.

III. Status of Claims

Claims 1-20 are pending in this application. Claims 1-10 and 16-20 are rejected. Claims 11-15 are withdrawn. No claims are currently allowed. The claims on Appeal, 1-10 and 16-20, are set forth in the attached Appendix.

IV. Status of Amendments

The Response After Final submitted on May 17, 2007 was considered and entered by the Examiner in an Advisory Action mailed May 29, 2007, however, no claims were allowed.

V. Summary Of Claimed Subject Matter

Claim 1

A method for manufacturing an interconnect (200, Figures 2-7) for an integrated circuit, comprising forming a surface conductive lead (520, Figure 5, page 14, lines 16-17) in an opening (230, Figure 2, page 12, lines 2-3) formed within a protective overcoat (210, Figure 2, page 12, lines 1-3) and over a barrier layer (310, Figure 3, page 13, lines 1-4), a portion of the barrier layer extending beyond the surface conductive lead (Figure 6, page 16, lines 17-19); and subjecting the portion of the barrier layer to a dry etch (Figure 7, page 17, lines 11-12) to remove the portion and form a skirt (725, Figure 7, page 17, lines 4-6), the dry etch selective to the barrier layer (page 3, lines 16-17).

Claim 16

A method for manufacturing an integrated circuit (800, Figure 8 and Figures 3-7), comprising forming transistor devices over a semiconductor substrate (Figure 8, page 19, lines 4-9); forming one or more metallization layers (220) over the transistor devices, the one or more metallization layers interconnecting one or more of the transistor devices (Figure 2, pages 11, lines 20-24); forming a protective overcoat (210, Figure 2, page 12, lines 1-3) over the one or more metallization layers, wherein the protective overcoat has an opening (230, Figure 2, page 12, lines 2-3) located therein; forming a surface conductive lead (520, Figure 5, page 14, lines 16-17) in the opening and over a barrier layer (310, Figure 3, page 13, lines 1-4), a portion of the barrier layer extending beyond the surface conductive lead (Figure 6, page 16, lines 17-19); and subjecting the portion of the barrier layer to a dry etch (Figure 7, pages 17, lines 11-12) to remove the

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portion thereby forming a skirt (725, Figure 7, page 17, lines 4-6), the dry etch selective to the barrier layer (page 3, lines 16-17).

VI. Grounds of Rejection to be Reviewed on Appeal

(A) Whether claims 1, 5-7, 9, 10, 16-17 and 19-20 recite patentable subject matter under 35 U.S.C. § 103(a) over *Wang* (U.S. Patent No. 6,544,878) in view of *Harris* (U.S. Patent No. 4,258,382).

(B) Whether claims 2-4 recite patentable subject matter under 35 U.S.C. § 103(a) over *Wang* (U.S. Patent No. 6,544,878) in view of *Harris* (U.S. Patent No. 4,258,382), and further in view of *Ashby et al.* (U.S. Patent No. 5,814,238).

(C) Whether claims 8 and 18 recite patentable subject matter under 35 U.S.C. § 103(a) over *Wang* (U.S. Patent No. 6,544,878) in view of *Harris* (U.S. Patent No. 4,258,382), and further in view of *Backus* (U.S. Patent No. 4,849,124).

VII. Argument

(A) The Rejection under 35 U.S.C. § 103(a) of claims 1, 5-7, 9, 10, 16-17 and 19-20 as unpatentable over *Wang* in view of *Harris* is improper and should be Reversed.

Claims 1, 5-7, 9, 10, 16-17 and 19-20

In view of the Examiner's grouping of independent claims in the rejection, and the common steps of these independent claims, the following will address the independent claims as a whole, while submitting that the following also applies to each independent claim singularly.

It will be appreciated by those skilled in the art that the invention in claims 1 and 16 addresses, *inter alia*, forming a surface conductive lead in the opening (within a protective overcoat) and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead; and subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, the dry etch selective to the barrier layer.

Appellants respectfully submit that the applied combination of *Wang* in view of *Harris* fails to teach or suggest at least these features and, as such, the Examiner has failed to present a *prima facie* rejection from the outset. This rejection is therefore in error and should be reversed.

It is the Examiner's position that *Wang* discloses the features claimed with the exception of subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt. *Harris* is therefore applied in combination with *Wang* as disclosing a skirt (36) in a "barrier layer" 28b. In the Advisory Action, the Examiner re-

asserted that claims 1 and 16 were broad enough to be anticipated by any layer under a surface conductive lead that prevents direct contact with an underlying bond pad, thus "acting" as a barrier layer.

To the contrary, Appellants' specifically and separately claim each of a barrier layer and surface conductive lead. According to a plain reading of *Harris*, both portions 28a and 28b collectively form the bump bond 28, with portion 28b coincidentally including a skirt 36.

To suggest that layer 28b of *Harris* is a "barrier" layer requires interpretation of *Harris* in a manner not supported therein, and is clearly based on hindsight afforded by way of Appellants invention. Appellants are confident that the Board will appreciate that the bump bond of *Harris*, even if formed in layers 28a and 28b to render a distinct shape, is still a bump bond *per se* rather than a separate barrier layer as claimed.

By way of direct reference to *Harris*, the disclosure thereof never deviates from the characterization of the **bump** 28 being "built up on the connecting pad". See at least Abstract; column 3, lines 3-5 ("a bump built up on the connecting pad"); column 3, lines 17-20 ("the pad must be sufficiently large in surface area to insure that the base of the bump does not overlap the edges of the pad"); column 3, lines 25-26 ("the skirt of the bump"); and column 4, line 55 ("a bump of conductive metal mounted on said pad") of *Harris*.

Accordingly, it is unclear how the Examiner is able to identify a purpose of the skirt 36 or attribute any significance or function to the layers 28a and 28b in *Harris* when *Harris* himself entirely fails to do so. Instead, *Harris* is concerned with the enlargement of the bonding pad 26 such that the base of the bump bond 28 (particularly the portion

28b including skirt 36 thereof) does not overlap the edges of the bonding pad, thereby enabling the bonding pad to expand when pressure is applied during the bonding process. It is understood from the disclosure of *Harris* that when the bonding pad is able to expand, stress applied to the bump bond during bonding processes will not crack the underlying silicon dioxide layer. Thus, the skirt 36 is simply a part of the bump bond 28, and its necessarily fixed size is overcome by enlarging the bonding pad 26.

Appellants' claimed invention clearly and patentably distinguishes over the combination of *Wang* in view of *Harris* in that the barrier layer of the claimed invention is dry etched to form the skirt. It is Appellants position that one of ordinary skill in the art would not look to a skirted bump bond as a teaching, motivation, or suggestion to provide a skirt on a barrier layer, particularly when the teaching of the primary reference is to fully etch a barrier layer to expose a passivation layer. It is submitted that the combination of *Wang* in view of *Harris* is entirely based on hindsight. Further, the combination, even if made, fails to teach or suggest Appellants' claimed invention.

Thus, *Wang* in view of *Harris* fail to disclose, teach or suggest dry etching the barrier layer to remove a portion thereof and form a skirt as recited by claims 1 and 16.

Accordingly, it is Appellants' position that *Wang*, as admitted by the Examiner, fails to teach the features recited by at least independent claims 1 and 16, and *Harris* fails to supply the missing teachings of *Wang*. Thus, the Examiner has failed to establish a *prima facie* rejection from the outset and the rejection with respect to claims 1, 5-7, 9, 10, 16-17 and 19-20 should be REVERSED.

(B) The Rejection under 35 U.S.C. § 103(a) of claims 2-4 as unpatentable over *Wang* in view of *Harris* and further in view of *Ashby et al.* is improper and should be Reversed.

Claims 2-4

Claims 2-4 are directed to the environment of the dry etch. The Examiner acknowledges that the combination of *Wang* in view of *Harris* fails to teach or suggest the etch environment and has therefore applied *Ashby et al.* as disclosing these features.

It is respectfully submitted that the initial combination of *Wang* and *Harris* is improper at the outset. Further, even if combinable, Appellants respectfully submit that *Wang* in view of *Harris* fail to disclose, teach or suggest the features recited by claim 1 of, *inter alia*, forming a surface conductive lead in the opening (within a protective overcoat) and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead; and subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, the dry etch selective to the barrier layer. *Ashby et al.* fail to supply the missing teachings of *Wang* and *Harris*. Thus, claims 2-4, as depending from an allowable independent claim, are patentable over *Wang* in view of *Harris* and *Ashby et al.*

Accordingly, the Examiner has failed to establish a *prima facie* rejection from the outset, and the rejection with respect to claims 2-4 should be Reversed.

(C) The rejection of claims 8 and 18 under 35 U.S.C. § 103(a) over *Wang* in view of *Harris*, and further in view of *Backus* is improper and should be Reversed.

Claims 8 and 18

Claims 8 and 18 are directed to wet etch of a seed layer. The Examiner acknowledges that the combination of *Wang* in view of *Harris* fails to teach or suggest the etch environment and has therefore applied *Backus* as disclosing these features.

It is respectfully submitted that the initial combination of *Wang* and *Harris* is improper at the outset. Further, even if combinable, Appellants respectfully submit that *Wang* in view of *Harris* fail to disclose, teach or suggest the features recited by claims 1 and 16 of, *inter alia*, forming a surface conductive lead in the opening (within a protective overcoat) and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead; and subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, the dry etch selective to the barrier layer. *Backus* fail to supply the missing teachings of *Wang* and *Harris*. Thus, claims 8 and 18, as depending from allowable independent claims 1 and 16, respectively, are patentable over *Wang* in view of *Harris* and *Ashby et al.*

Accordingly, the Examiner has failed to establish a *prima facie* rejection from the outset, and the rejection with respect to claims 8 and 18 should be Reversed.

VIII. Conclusions

The claimed invention clearly provides forming a surface conductive lead in an opening formed within a protective overcoat and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead, and subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, which is neither taught nor suggested by the applied references.

Accordingly, Appellants respectfully request Reversal of the outstanding rejections in the present application.

To the extent any further extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this Appeal Brief; such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 20-0668.

Respectfully submitted,

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VIII. Claims Appendix

1. A method for manufacturing an interconnect for an integrated circuit, comprising:
 - forming a surface conductive lead in an opening formed within a protective overcoat and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead; and
 - subjecting the portion of the barrier layer to a dry etch to remove the portion and form a skirt, the dry etch selective to the barrier layer.
2. The method as recited in Claim 1 wherein the dry etch includes carbon tetraflouride.
3. The method as recited in Claim 2 wherein the dry etch further includes nitrous oxide.
4. The method as recited in Claim 2 wherein the dry etch further includes oxygen or chlorine.
5. The method as recited in Claim 1 wherein the barrier layer is a tungsten titanium barrier layer.
6. The method as recited in Claim 1 wherein the barrier layer has a thickness ranging from about 200 nm to about 300 nm.

7. The method as recited in Claim 1 further including a seed layer located between the barrier layer and the surface conductive lead, and further including subjecting the seed layer to a wet etch prior to subjecting the portion of the barrier layer to the dry etch.
8. The method as recited in Claim 7 wherein the wet etch includes an etch chemistry including hydrogen peroxide and sulfuric acid.
9. The method as recited in Claim 1 wherein the surface conductive lead has a width ranging from about 3 μm to about 200 μm .
10. The method as recited in Claim 1 wherein the protective overcoat comprises one or more layers selected from the group consisting of silicon oxynitride layers, silicon oxide layers, and silicon nitride layers, phospho-silicate glass layers, and organic polymer layers.
16. A method for manufacturing an integrated circuit, comprising:
 - forming transistor devices over a semiconductor substrate;
 - forming one or more metallization layers over the transistor devices, the one or more metallization layers interconnecting one or more of the transistor devices;
 - forming a protective overcoat over the one or more metallization layers, wherein the protective overcoat has an opening located therein;

forming a surface conductive lead in the opening and over a barrier layer, a portion of the barrier layer extending beyond the surface conductive lead; and subjecting the portion of the barrier layer to a dry etch to remove the portion thereby forming a skirt, the dry etch selective to the barrier layer.

17. The method as recited in Claim 16 further including a seed layer located between the barrier layer and the surface conductive lead, and further including subjecting the seed layer to a wet etch prior to subjecting the portion of the barrier layer to the dry etch.
18. The method as recited in Claim 17 wherein the wet etch includes an etch chemistry including hydrogen peroxide and sulfuric acid.
19. The method as recited in Claim 16 wherein the surface conductive lead has a width ranging from about 3 μm to about 200 μm .
20. The method as recited in Claim 16 wherein the protective overcoat comprises one or more layers selected from the group consisting of silicon oxynitride layers, silicon oxide layers, and silicon nitride layers, phospho-silicate glass layers, and organic polymer layers.

IX. Evidence Appendix

NONE

X. Related Proceedings Appendix

NONE